(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 180 407**
B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **31.05.89**

(51) Int. Cl.[4]: **G 03 G 15/09**

(21) Application number: **85307656.0**

(22) Date of filing: **23.10.85**

(54) Developing device.

(30) Priority: **29.10.84 JP 227411/84**

(43) Date of publication of application:
07.05.86 Bulletin 86/19

(45) Publication of the grant of the patent:
31.05.89 Bulletin 89/22

(84) Designated Contracting States:
DE FR GB NL

(56) References cited:
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US-A-4 385 829

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EP 0 180 407 B1

Courier Press, Leamington Spa, England.

Description

The present invention relates to a developing device for developing an electrostatic latent image.

Developing in the dry-type electrophotographic method is the most important element which has influence directly on the image quality and various methods such as the cascade method and the magnet brush method have conventionally been used. The reason is that in these developing methods, toner is easily charged and that a stable image can be obtained.

However, in the cascade method, it is impossible to copy the solid part of an image satisfactorily due to fringe effect at developing. In the magnet brush method such defects are few. The magnet brush method is most commonly used, however, it has the defect that the life of carrier particles used with toner particles is comparatively short. Therefore, it is necessary to replace the carrier particles after every ten thousand copies.

In order to reduce the occurrence of such defects in these methods, a system had been developed recently in which the shape and the material of carrier particles were improved. Under the circumstances, a copying machine using the so-called magnetic single component developing system has been increasing in popularity. This system is classified into two types of system, one using conductive toner and the other using insulating toner. In order to improve operation in moist conditions the latter system is preferable. However, it is difficult to charge such toner stably. Consequently, defects occur such as non-uniformity, poor background quality, and non-uniform density.

Another advantage of the one component system is that it is possible to develop the electrostatic latent image surface without contacting it, and this advantage is important in color copying technology where overlap developing is required. However, it is difficult to make magnetic toner colored. The reason is that most magnetic powder which is usable as toner is black or brown and the color of the toner becomes very muddy when mixed.

In order to satisfy the above requirement, it is desirable to produce a developing system in which an image is produced on the electrostatic latent image surface by using non-magnetic toner in a non-contacting mode. However, this involves many unsatisfactory elements in practice. One of the well-known techniques is one in which an image is developed by forming a thin layer of toner on the surface of a conductive roller and positioning it facing a developing surface carrying an electrostatic latent image at a space of 600 µm or less, preferably 250 µm or so. This method, however, has the following two disadvantages. First, there is no reliable means for forming a thin layer (50 µm or less) of toner. At present, a method of applying toner by pressing a rubber blade against a roller is commonly used, but there remains such problems as density of toner layer to be formed and wear of blade. Second, the formed thin layer of toner must be charged uniformly. In this means, the charging rate of toner is low, and a satisfactory charging and stability cannot be obtained and the image quality also is unstable. A trial was made for improviing the charging quality and the film forming quality of toner, but improvement of toner is put under a large burden. This means, therefore, it is at the experimental stage in laboratories. The same problem also for developing toner materials to improve charging nature on the roller surface still remains.

In the conventional developing device (see e.g., U.S. Pat. No. 4,383,497) comprising a magnetic roller to form a magnetic brush with two component developer consists of magnetic carrier particles which electrostatically attracts toner particles; and a developing roller which passes by the magnetic roller and contacts the magnetic brush such that the toner particles are separated from the magnetic carrier particles and then toner particles are received on the developing roller, and which passes a developing station where the development is effected. With this conventional device a satisfactory and stable image quality was obtained, but an unfavorable defect was generated that toner is scattered in the copying machine when toner is separated from two component developer.

The present invention has been made in view of the above-mentioned problems, and aims at providing an excellent developing device.

Another object of the present invention is to provide a developing device wherein a thin layer of non-magnetic toner can be easily formed and a satisfactory charging toner layer can be formed on a developing roller.

Still another object of the present invention is to provide a developing device on a developing roller to perform non-contacting developing and which an image can be developed satisfactorily without scattering of toner.

Accordingly the present invention provides a developing device for an electrostatic image forming system, in which development is effected by transferring toner particles by means of an electrostatic field formed between a toner layer and electrostatic image surface, the device comprising:

a casing for storing a developer comprising carrier particles and toner particles;

a developer bearing roller rotatably mounted in the casing, the developer bearing roller holding the developer thereon;

a developing roller rotatably mounted in the casing in operative association with the developer bearing roller and protruding through the opening of the casing to face the electrostatic image surface;

means (E2) for creating a difference in electrical potential between the surface of the developer bearing roller so as to separate the toner particles only from the developer held on the developer

bearing roller and to attract the toner particles onto the developing roller to form a toner layer on the developing roller; characterised by:

a first elastic blade having a fixed end and a free end, the first elastic blade being mounted on the casing above the developing roller and, during use of the device, making resilient sliding contact with the toner particles on the surface of the developing roller intermediate its fixed end and its free end and across the width of the opening in the casing; and

a second elastic blade having a fixed end and a free end, the second elastic blade being mounted on the casing beneath the developing roller and, during use of the device, making resilient sliding contact with the toner particles on the surface of the developing roller intermediate its fixed end and its free end and across the width of the opening in the casing, whereby said blades substantially close the said opening.

A more complete appreciation of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

Fig. 1 is a schematic cross-sectional side view of a copying machine in which the developing device of the present invention is employed:

Fig. 2 is a schematic structural design of an actual developing device according to the present invention;

Fig. 3 is a diagram for explaining the state of separation operation of toner of the developing device according to the present invention;

Fig. 4 is a disassembled perspective view of the developing device according to the present invention;

Fig. 5 is a modified structural diagram of the developing device according to the present invention; and

Fig. 6 is an explanatory view of the essential parts of Fig. 5.

Referring now to the drawings, wherein like reference numerals designate identical or corresponding parts throughout the several views, Fig. 1 is a schematic cross-sectional side view of a copying machine in which the developing device of the present invention is employed. In substantially the center of a casing 1 of the copying machine, a photosensitive drum 2 comprising selenium and tellurium alloy rotatable in the direction of arrow A. At the upper part of casing 1, an original table 3 is provided to place thereon an original and reciprocative in the direction of arrows B and B'. At the lower part of original table 3, an exposure lamp 4 is provided to irradiate light to the original placed on table 3 and light can be irradiated from one end to the other end of the original with movement of original table 3. A reflecting light from the original is irradiated on the surface of photosensitive drum 2 through an optical lens array 5.

Near photosensitive drum 2, a discharge lamp 6 is provided to erase any image (residual changes) remaining on the photosensitive drum 2. A DC corona charger 7 is provided next to cold cathode lamp 6 for charing the surface 2a of photosensitive drum 2 to be positive. An electrostatic latent image is formed on the surface of photosensitive drum 2 charged by DC corona charger 7 after discharged by cold cathode lamp 6, by exposing with the reflecting light from the original placed on table 3. In the forward direction of charger 7, a developing device 8 is provided for developing the electrostatic latent image by developer or toner. Further, in the forward direction of developing device 8, an AC corona charge remover 9 is provided to fine negative charges toner on drum 2 with removes charges on drum 2. In the forward direction of remover 9, a sheet feeder 10 is provided for supplying sheets under photosensitive drum 2. Sheet feeder 10 is removably provided on the side of casing 1, and comprising a sheet cassette 11 storing a plurality of sheets P and a feed roller 12 taking out copy sheets P from sheet cassette 11. Further, in the upper direction of sheet cassette 11, a bypath-feed device 13 is provided and feed rollers 14 are provided for feeding forward copy sheets P fed from bypath-feed device 13. Also, aligning rollers 15 are provided for positioning the leading edge of copy sheets P fed from sheet cassette 11 or bypath-feed device 13 and for transporting copy sheets P. In the forward direction of sheet feeder 10, an image transfer charger 16 is provided for transferring the image formed on the surface of photosensitive drum 2 to copy sheets P transported by aligning rollers 15. A sheet separation charger 17 is provided next to image transfer charger 16 for separating copy sheets P which the image is transferred from photosensitive drum 2. In the forward direction of sheet separation charger 17, a cleaner 18 is provided for recovering and accumulating the toner remained on photosensitive drum 2 after image transferring.

Copy sheets P separated after image transferring are transported to a fuser 20 by a transportation belt 19. Fuser 20 is a device fixing the developed image transferred on the transporter copy sheets P with heat rollers 21. Copy sheets P fixed by fuser 20 are taken out on an external receiving tray 23 through discharge rollers 22.

Fig. 2 shows a construction of developing device 8. In a casing 31, a developer 32 is stored. Developer 32 comprising magnetic carrier such as iron particles and ferrite mixed with 2.0—7.0 weight percent negatively charged toner b. Also, in casing 31, a non-magnetic cylindrical sleeve 33 is provided as a developer bearing member, which is rotated in the direction of arrow C shown in the drawing. And a magnet 33_1 the magnetic poles N and S of which are alternatively disposed, is fixedly provided inside sleeve 33. Further, in casing 31, a developer roller 34 is provided as a toner holding member, which is rotated in the direction of arrow D shown in the drawing. Developing roller 34 is disposed close to cylindrical sleeve 33 and faces photosensitive drum 2 at a gap g. A thickness regulating plate 35 is provided

at inside wall of casing 31 for regulating the thickness of the magnetic brush formed on cylindrical sleeve 33 to 1.0—4.0 mm. A toner hopper 36 and a sponge roller 38 supplying the toner b in toner hopper 36 to a developer storing portion 37 are provided above cylindrical sleeve 33.

As shown in Fig. 3, developing roller 34 has a construction wherein a layer 34b of oxidised aluminium treated, epoxy system or polyamide system resin is formed as an insulative layer or a resistive layer of 5.0—60.0 μm thickness on the surface of a conductive member 34a such as aluminum.

By providing layer 34b of an insulative layer or a resistive layer on the surface of developing roller 34, as shown in Fig. 3, concentration of a partial current is prevented when toner b is separated by voltage applied between carrier a, toner b, and developing roller 34 and the uniformity of the layer thickness of toner b is obtained. Also, the surface of developing roller 34 is roughing treated to approximately to 0.5—2.0 μm. This contributes to uniformization of the toner layer. The surface treatment, especially the resistive layer treatment is not always necessary and metal roller without surface layers can be used.

Developing roller 34 is rotated at substantially equal speed to the peripheral speed of photosensitive drum 2 and non-magnetic cylindrical sleeve 33 is rotated at a speed of two or three times in the same direction or the reverse direction to developing roller 34. Also, developing roller 34 is connected to an AC power source E_1 one end of which is earthed. Further, a DC power source E_2 is connected as an electrical means between developing roller 34 and non-magnetic cylindrical sleeve 33.

Next, separation of the toner a between developing roller 34 and non-magnetic cylindrical sleeve 33 is described referring to Fig. 3. For example, when a DC voltage E_2 of 200—600 V is applied between developing roller 34 and cylindrical sleeve 33 as shown in Figure 3, toner b negatively charged by friction is adsorbed electrostatically to developing roller 34 and a thin layer T is formed on resistive layer 34b of developing roller 34. The thickness of the thin layer T is adjusted by the voltage to be applied, but usually, the thickness is formed by 2 or 3 layers of toner b having a particle diameter of 10 μm or so, that is, it is 20—30 μm or so. Toner layer T formed as mentioned above is separated from two component developers 32, and it is formed of toner particles which are uniform and charged to a desired degree. Therefore, when it faces photosensitive drum 2 with a gap g of 0.1—0.7 mm in the developing station, substantially the same developing sensitivity as in the normal electrophotographic developing method can be obtained. In this system, the toner b flies across the gap g, and it is necessary to set the gap g to 0.2—0.3 mm to maintain resolution. Further, in order to promote movement of the toner b and to give an electrical shaking effect, on an AC bias, voltage of 0.4 kB is applied. As a result, the image quality and the sensitivity in low density areas can be improved.

Two component developers 32 in developer storing part 37 scatters a sufficient amount of toner b by rotation of cylindrical sleeve 33 and a cloud of toner fills the space 39 in developing device 8. In a conventional developing device, this toner cloud is spouted from the device and may soil the inside of the copying machine. However, in the device, of the invention, so as to provide improved shielding resilient blades 40 and 41 made of stainless steel or phosphor bronze are made to contact the developing roller 34. In this case, it is important to press developing roller 34 with a uniform force so that the uniformity of the toner layer separated from two component developer 32 and formed on developing roller 34 by a magnetic brush is not reduced. For this reason, the blades 40 and 41 are positioned so that they contact the roller surface and that the linear pressure of blade 40 is 50—200 g/cm and that of blade 41 is 40—100 g/cm. Thus, toner b is transported smoothly and the triboelectric charging effect due to sliding contact of the separate toner layer T and the blades and removal of brush trace due to the magnetic brush are performed satisfactorily. As a result, a high quality image can be obtained. The thickness of blades 40 and 41 used in this case were 0.1—0.25 mm and the length from the fulcrum of the blades to the contact surface of developing roller 34 is approximately 30—40 mm and these numerical values were optimum. However, these values change by material and construction, and they are not always absolute. Also, blade 41 is not always required when the machine is used for a short period of time because developer regulating plate 35 prevents scattering of toner. Although contacting type shields have not been used previously because toner layer T formed on developing roller 34 is disturbed by any slight external forces, it has now been found that this problem is resolved by employing "surface contact" of a plate-shaped elastic member. This avoids the possibility of "squeezing" the toner off the surface.

Figure 4 is a disassembled perspective view of developing device 8 where elastic blade 40 is used. As the components other than those already described, there are provided side frames 42 and 43 for fixing developing roller 34, cylindrical sleeve 33, and toner hopper 36. Also, gears 46, 47 and 48 for driving sponge roller 38, cylindrical sleeve 33, and developing roller 34 are mounted.

Further, on both ends of the shaft of developing roller 34, guide rings 44 and 45 having the outside diameter 400—500 μm larger than that of developing roller 34 are provided. During rotating these contact the both end surfaces of photosensitive drum 2, so the gap between developing roller 34 and drum 2 is held with high precision. Inside the side frames 42 and 43, felt strips 50 are provided so that they shield the edges of both ends of elastic blade 40. These felt strips prevent leakage of toner.

It is to be understood that the foregoing description is a preferred embodiment of the disclosed device and the various changes in construction as

shown in Figures 5 and 6 may be made in the invention. In these examples, an upper elastic blade 49 for preventing scattering of toner and for triboelectric charging of toner b is positioned so that the contacting end thereof faces the rotation of developing roller 34 as shown in the drawings (the lower blade is not shown). Further, as shown in Figure 6, the gap h formed between the projection at the end of blade 49 and the developing roller 34 is adjusted so that it is smaller than the particle of carriers a in the developer to be used. Therefore, when carriers erroneously adhere to developing roller 34 at separation of toner from a magnetic brush no carrier intrudes into the gap, and damage of the developing roller and striping of toner layer T are prevented. In this case, it is preferable that the diameter of carriers a is comparatively large, preferably 80—150 μm.

As described above, utilising the principles of the present invention, scattering of toner of a non-contacting developing device of two component developer separation system can be completely prevented and the toner layer can be easily made uniform. Also, the toner density in the two component developer can be increased to more than the conventional density without scattering of the toner. As a result, separation of toner can be effectively performed, but charging of toner is insufficient in this state. However, triboelectric charging of toner is performed by sliding contact of blade 40 or 49, so a compensation sufficient for obtaining a good image quality is performed.

Claims

1. A developing device for an electrostatic image forming system, in which development is effected by transferring toner particles by means of an electrostatic field formed between a toner layer and electrostatic image surface, the device comprising:

a casing (31) for storing a developer comprising carrier particles and toner particles;

a developer bearing roller (33) rotatably mounted in the casing (31), the developer bearing roller (33) holding the developer thereon;

a developing roller (34) rotatably mounted in the casing (31) in operative association with the developer bearing roller (33) and protruding through the opening of the casing (31) to face the electrostatic image surface;

means (E2) for creating a difference in electrical potential between the surface of the developer bearing roller (33) so as to separate the toner particles only from the developer held on the developer bearing roller (33) and to attract the toner particles onto the developing roller (34) to form a toner layer on the developing roller (34); characterised by:

a first elastic blade (40) having a fixed end and a free end, the first elastic blade (40) being mounted on the casing (31) above the developing roller (34) and, during use of the device, making resilient sliding contact with the toner particles on the surface of the developing roller (34) intermediate its fixed end and its free end and across the width of the opening in the casing (31); and

a second elastic blade (41) having a fixed end and a free end, the second elastic blade (41) being mounted on the casing (31) beneath the developing roller (34) and, durng use of the device, making resilient sliding contact with the toner particles on the surface of the developing roller (34) intermediate its fixed end and its free end and across the width of the opening in the casing (31), whereby said blades substantially close the said opening.

2. A developing device as claimed in claim 1 further comprising a toner hopper (36) mounted in the casing (31) above the developer bearing roller (33) in a position to drop toner particles onto the developer bearing roller (33).

3. A developing device as claimed in claim 1, wherein the developer bearing roller comprises a non-magnetic sleeve (33) and a magnet (33_1) disposed inside the non-magnetic sleeve (33).

4. A developing device as claimed in claim 1, wherein the developing roller (34) comprises a conductive member (34a) and an insulative or resistive layer (34b) of 5—60 μm thickness formed on the surface of the conductive member.

5. A developing device as claimed in claim 1, wherein:

the developing roller (34) comprises a conductive roller;

the electrostatic image is formed on a photosensitive drum (2); and

the conductive roller is rotated at substantially the same speed as the peripheral speed of the photosensitive drum (2).

6. A developing device as claimed in claim 1, wherein the means for creating a potential difference includes a DC voltage source (E2).

7. A developing device as claimed in claim 1, wherein said resilient blade (49) forms a gap (h) between the blade edge and the surface of said developer roller (34), which gap is smaller than the particle diameter of the carrier particles in the developer.

Patentansprüche

1. Entwicklungsvorrichtung für ein elektrostatisches Bilderzeugungssystem, in der die Entwicklung durch Übertragung von Tonerpartikeln mit Hilfe eines elektrostatischen Feldes erfolgt, das zwischen einer Tonerschicht und einer elektrostatischen Bildfläche erzeugt wird, mit

einem Gehäuse (31) zur Aufnahme eines Entwicklers, der aus Trägerpartikeln und Tonerpartikeln besteht,

einer Entwicklertragrolle (33), die drehbar im Gehäuse (31) angeordnet ist und den Entwickler aufnimmt,

einer Entwicklungswalze (34), die drehbar im Gehäuse (31) angeordnet ist und in Wirkverbindung mit der Entwicklertragwalze (33) steht und durch die Öffnung im Gehäuse (31) ragt, um so der elektrostatischen Bildfläche gegenüberzuliegen,

einer Einrichtung (E2) zur Erzeugung einer elektrischen Potentialdifferenz zur Fläche der Entwicklertragwalze (33), um die Tonerpartikel lediglich vom Entwickler zu trennen, der auf der Entwicklertragwalze (33) gehalten wird und um die Tonerpartikel auf die Entwicklungswalze (34) zu ziehen, zur Bildung einer Tonerschicht auf der Entwicklungswalze (34), gekennzeichnet durch

ein erstes elastisches Blatt (40) mit einem fixierten Ende und einem freien Ende, wobei das erste elastische Blatt (40) am Gehäuse (31) angebracht ist oberhalb der Entwicklungswalze (34) und beim Betrieb der Vorrichtung in nachgiebigem Gleitkontakt mit den Tonerpartikeln auf der Oberfläche der Entwicklungswalze (34) zwischen seinem fixierten Ende und seinem freien Ende und über die Breite der Öffnung im Gehäuse (31) steht, und

ein zweites elastisches Blatt (41) mit einem fixierten Ende und einem freien Ende, wobei das zweite elastische Blatt (41) am Gehäuse (31) unterhalb der Entwicklungswalze (34) angeordnet ist und beim Betrieb der Vorrichtung in nachgiebigem Gleitkontakt mit den Tonerpartikeln auf der Oberfläche der Entwicklungswalze (34) zwischen seinem fixierten Ende und seinem freien Ende und über die Breite der Öffnung im Gehäuse (31) steht, wodurch die Blätter die Öffnung im wesentlichen verschließen.

2. Entwicklungsvorrichtung nach Anspruch 1, gekennzeichnet ferner durch einen Tonervorratsbehälter (36), der im Gehäuse (31) oberhalb der Entwicklertragwalze (33) in einer Position angeordnet ist, aus der Tonerpartikel auf die Entwicklertragwalze (33) fallen.

3. Entwicklungsvorrichtung nach Anspruch 1, bei der die Entwicklertragwalze eine nichtmagnetische Hülse (33) und einen innerhalb der nichtmagnetischen Hülse (33) angeordneten Magneten (33_1) aufweist.

4. Entwicklungsvorrichtung nach Anspruch 1, bei der die Entwicklungswalze (34) ein leitfähiges Teil (34a) und eine Isolations- oder Widerstandsschicht (34b) von 5 bis 60 µm Dicke aufweist, die auf der Oberfläche des leitfähigen Teiles ausgebildet ist.

5. Entwicklungsvorrichtung nach Anspruch 1, bei der

die Entwicklungswalze (34) eine leitfähige Walze aufweist,

das elektrostatische Bild auf einer fotoempfindlichen Trommel (2) erzeugt wird, und

die leitfähige Walze mit im wesentlichen der gleichen Geschwindigkeit gedreht wird wie die Umfangsgeschwindigkeit der fotoempfindlichen Trommel (2).

6. Entwicklungsvorrichtung nach Anspruch 1, bei der die Mittel zur Erzeugung einer Potentialdifferenz eine Gleichspannungsquelle (E2) umfassen.

7. Entwicklungsvorrichtung nach Anspruch 1, bei der das nachgiebige Blatt (49) einen Spalt zwischen der Blattkante und der Oberfläche der Entwicklerwalze (34) erzeugt, wobei der Spalt kleiner ist als der Partikeldurchmesser der Trägerpartikel des Entwicklers.

Revendications

1. Dispositif de développement pour un système formant des images électrostatiques dans lequel le développement s'effectue en transférant des particules de toner au moyen d'un champ électrostatique formé entre une couche de toner et une surface portant une image électrostatique, qui comprend:

un carter (31) pour contenir un révélateur comprenant des particules de support ou "véhicules" et des particules de toner;

un rouleau porte-toner (33) monté à rotation dans le carter (31), le rouleau porte-toner (33) tenant le révélateur;

un rouleau de développement (34) monté à rotation dans le carter (31) de façon à coopérer avec le rouleau porte-révélateur (33) et s'avançant à travers l'ouverture du carte (31) en face de la surface portant l'image électrostatique;

des moyens (E2) pour créer une différence de potentiels électriques entre la surface du rouleau porte-révélateur (33) de façon à ne séparer que les particules de toner que du toner tenu à la surface du rouleau de développement (33) et à attirer ces particules de toner sur le rouleau de développement (34) afin de former une couche de toner sur ce dernier, caractérisé en ce qu'il comprend:

une première lame élastique (40) ayant une extrémité fixe et une extrémité libre, cette première lame élastique (40) étant montée sur le carter (31) au-dessus du rouleau de développement (34) et, pendant l'utilisation du dispositif, faisant un contact glissant élastique avec les particules de toner présentes à la surface du rouleau de développement (34), entre son extrémité fixe et son extrémité libre, et à travers la largeur de l'ouverture du carter (31); et

une seconde lame élastique (41) ayant une extrémité fixe et une extrémité libre, cette seconde lame élastique (41) étant montée sur le carter (31) sous le rouleau de développement (34) et, pendant l'utilisation du dispositif, faisant un contact élastique glissant avec les particules de toner présentes à la surface du rouleau de développement (34) entre son extrémité fixe et son extrémité libre et à travers la largeur de l'ouverture du carter (31), ce qui fait que lesdites lames ferment pratiquement ladite ouverture.

2. Dispositif de développement selon la revendication 1, caractérisé en ce qu'il comprend, en outre, une trémie à toner (36) montée dans le carter (31) au-dessus du rouleau porte-révélateur (33) en position pour que les particules de toner tombent sur le rouleau porte-révélateur (33).

3. Dispositif de développement selon la revendication 1, caractérisé en ce que le rouleau porte-révélateur comporte un manchon non-magnétique (33) à l'intérieur duquel est logé un aimant 33_1.

4. Dispositif de développement selon la revendication 1, caractérisé en ce que le rouleau de développement (34) comprend un rouleau conducteur (34a) et une couche isolante ou résistante (34b) d'une épaisseur de 5 à 60 µm formée à la surface du rouleau conducteur.

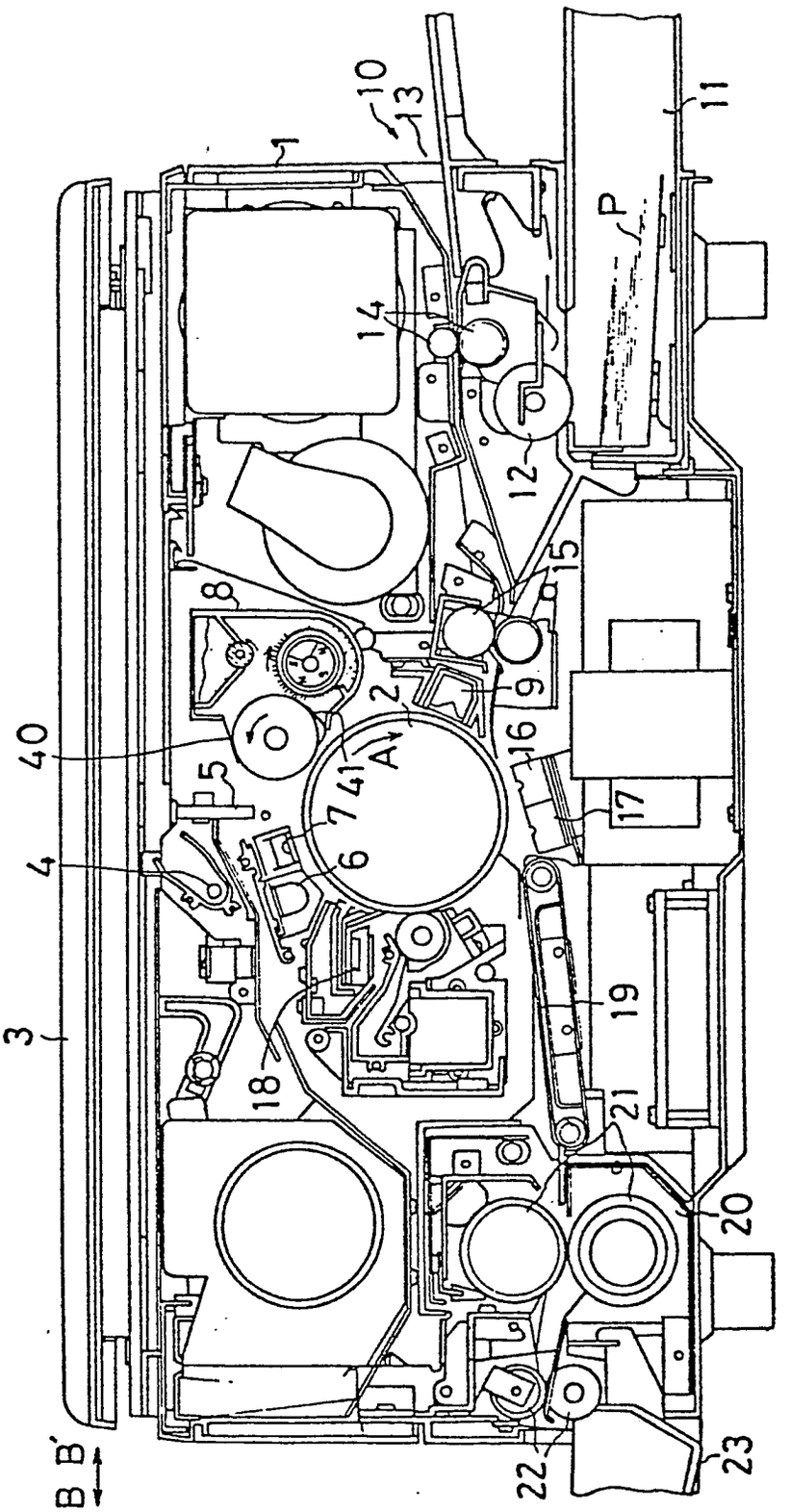
5. Dispositif de développement selon la revendication 1, caractérisé en ce que le rouleau de développement (34) est un rouleau conducteur;

en ce que l'image électrostatique est formée sur un tambour photosensible (2); et

en ce que le rouleau conducteur tourne pratiquement à la même vitesse périphérique que le tambour photosensible (2).

6. Dispositif de développement selon la revendication 1, caractérisé en ce que les moyens (E_2) pour créer la différence de potentiels comprennent une source électrique à courant continu.

7. Dispositif de développement selon la revendication 1, caractérisé en ce qu'un intervalle de la lame élastique (49) est formé entre le bord de la lame et la surface du rouleau de développement, intervalle qui est plus petit que le diamètre des particules de transport ou des "véhicules" du révélateur.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10
13
11
P
14
12
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8
9
2
16
40
A
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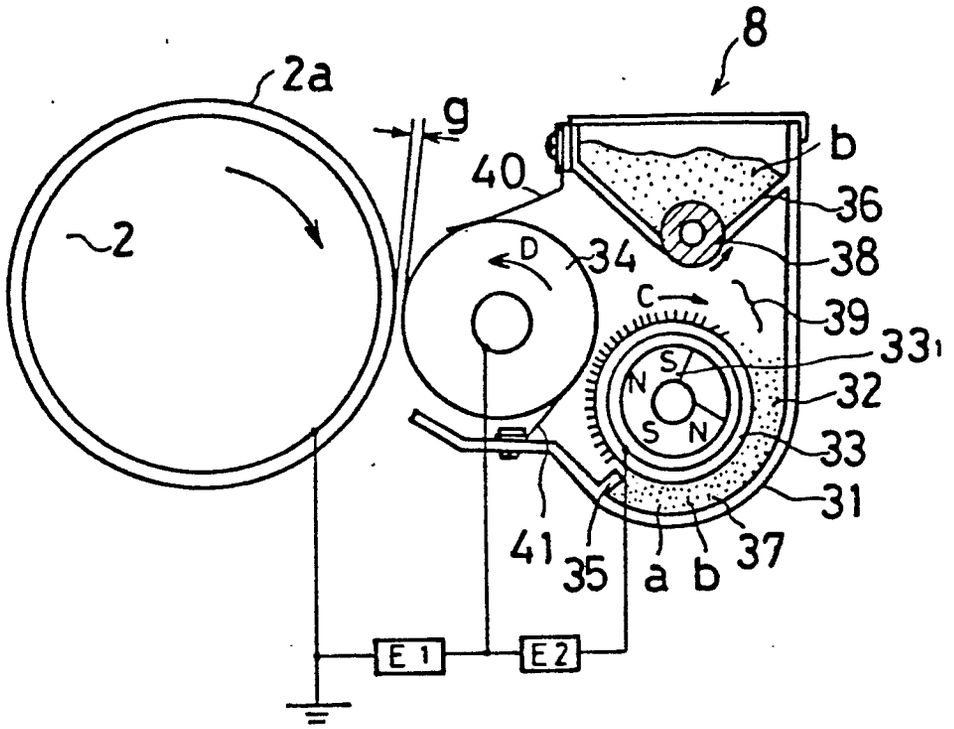
3
18
21
20
B
B'
22
23

FIG. 2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38
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b
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E1
E2

FIG. 3

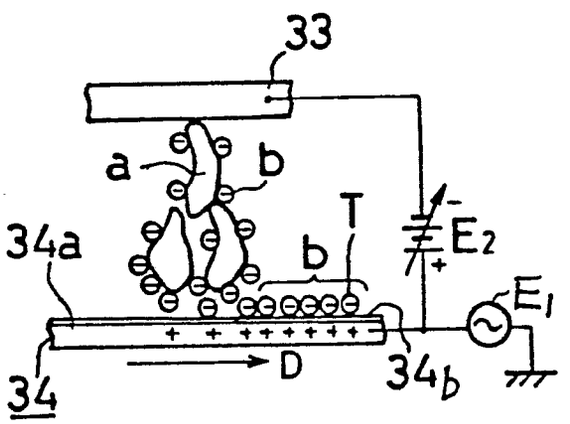
33
a
b
T
34a
b
E2
E1
D
34b
34

FIG. 4

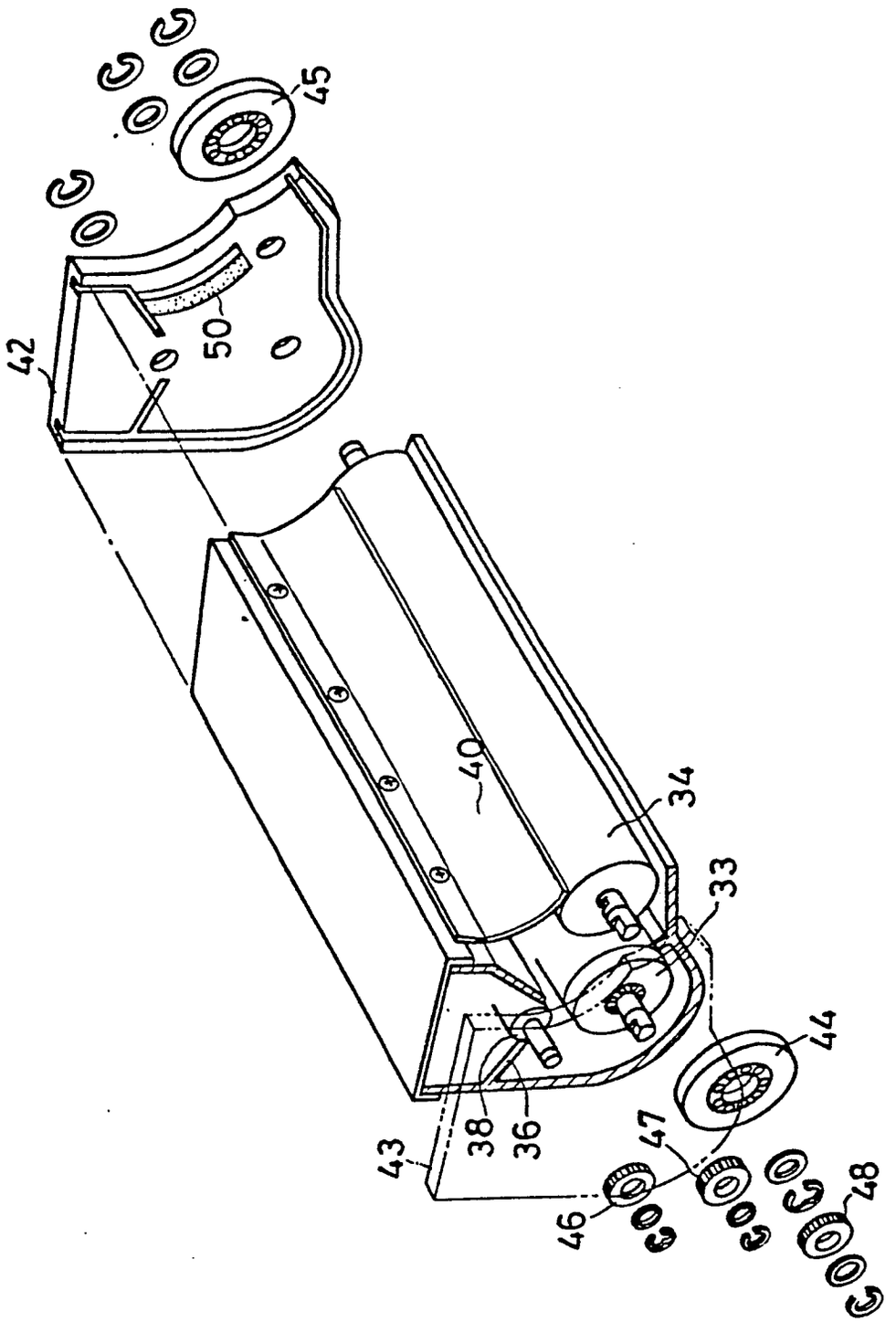

FIG. 5

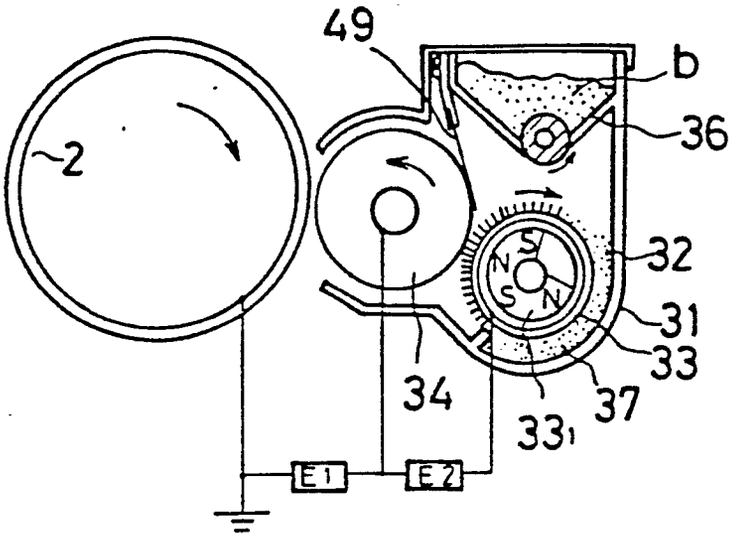

FIG. 6